

7-Year Neurodevelopmental Consequences of Prenatal Exposure to Chlorpyrifos, a Common Organophosphate Pesticide

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BACKGROUND AND AIMS: First registered in 1965 for agricultural and pest control purposes, chlorpyrifos is a broad-spectrum, chlorinated organophosphate (OP) insecticide. Early concerns about the possible neurotoxicity of OP insecticides for humans derived from animal studies showing that prenatal and early postnatal exposures to CPF were associated with neurodevelopmental deficits. In humans, prenatal exposures to chlorpyrifos (CPF) have been associated with neurodevelopmental problems in young children from different populations. The goal of the study was to determine the relationship between prenatal CPF exposure and 7-year neurodevelopment in an urban population.

METHODS: In a sample of 265 children (participants in a prospective study of air pollution), we measured prenatal CPF exposure in umbilical cord blood (pg/g), and 7-year neurodevelopment, using the Wechsler Intelligence Scales for Children (WISC-IV). Estimates of effect were obtained from multiple and logistic regression, adjusted for income, sex, race/ethnicity, home environment, child anxiety, secondhand smoke (ETS) and polycyclic aromatic hydrocarbons (PAH).

RESULTS: Prenatal CPF exposure was associated with 7-year deficits in Full-Scale IQ ($p=0.02$), Working Memory ($p=0.002$), and Verbal Comprehension ($p=0.08$). On average, for each standard deviation (4.61 pg/g) increase in exposure concentration, Full-Scale IQ declined by 1.7%, and Working Memory declined by 2.7%. CPF increased the risk of borderline function (< 80) on Full-Scale IQ (OR=1.13, 95% CI 1.04--1.23, $p=0.005$), Working Memory (OR=1.10, 95% CI 1.01--1.19, $p=0.03$), and Verbal Comprehension (OR=1.09, 95% CI 1.00--1.18, $p=0.05$).

CONCLUSIONS: We report significant 7-year deficits in Full-Scale IQ and Working Memory, as a function of prenatal CPF exposure. Higher exposure increased risk of borderline function in IQ, Working Memory, and Verbal Comprehension, with implications for learning and school achievement. These findings are important in light of continued widespread use of CPF in agricultural settings.